

Plastics Enlightened: An Exploration of LED Lighting and Recycled Design

An Honors Thesis (HONR 499)

by

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Abstract

LED lighting and sustainable design have become quite popular in recent years. Long lifetime, energy efficiency, durability, lack of UV emissions, low voltage, and flexibility in design are only some of the many benefits of utilizing LED lights. Issues of sustainability have sparked an interest in reusing and recycling commonly thrown away household materials such as papers, plastics, and glass. Together, LED lighting and recycled materials could provide an inexpensive alternative to many unsustainable lighting products bought in-store. Using only LED lights, plastic bottles, and small amounts of adhesives, original lighting designs may be created. I have developed a design for small, portable lights that explores various characteristics of LEDs and plastics, considers individual users' skillsets and design preferences, and provides profitable opportunities for creators.

Acknowledgements

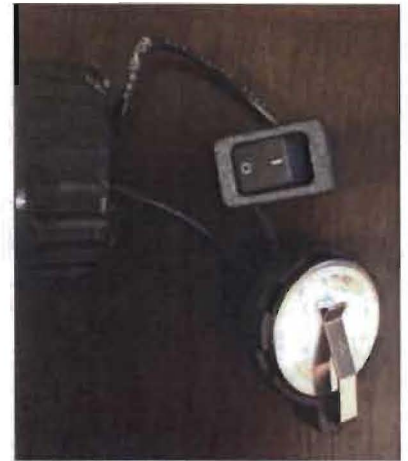
I would like to thank Ana de Brea for being my advisor throughout the course of this project.

The guidance and advice that I received from her for this project and throughout my college

career have challenged me in several ways and have influenced the designer that I am today.

Author's Statement

Developing innovative lighting design using LED technology and recycled or sustainable materials was the challenge at hand for this project. With little knowledge of the increasingly popular LED technology, I was prepared to begin experimenting. This project began with a little bit of LED trial and error. Small batteries were used to connect to and light small LED bulbs. In an early design experiment, a small on/off switch was soldered to connect with a battery that led to the LED bulb. The image on the right displays this experiment. Originally, this method of constructing each individual component for each product was planned to have been completed by the creator. However, after experimenting with various configurations of switches, battery holders, and the wires that connect them to the LED bulbs, it was concluded that the lengthy and fragile construction process was not worth the unappealing result. From this point on, the overall design would focus more on simple construction methods, although this would later change once again.



Experimentation then began with manipulation of plastics. Old plastic bottles that would have been thrown away were collected. One bottle was cut into smaller pieces and reshaped using the heat from a lit tea candle. Similar to the exploration of LED lighting, the reshaping of plastic pieces was very much a trial and error event. At first, pieces burned, melted, and some even caught on fire. It was concluded that various brands and types of plastic bottles reshaped in their own ways. I did not have very much control at all over how the plastic would react to the flame. Different shapes and sizes of the cut plastic pieces were reshaped very dissimilarly. Long, thin pieces would tend to curl up very quickly when heat was applied. Larger, rounder pieces'

edges would bend and curl slightly, but the centers would remain unaffected unless held directly to the flame. It was during this experimentation that more of a design concept was developed for the overall “look” of the project.

Several of the small, reshaped pieces of plastic very strongly resembled flower petals. Without much thought, I began to melt some of these “petals” together, eventually created what looked like an abstract flower. It was in that moment that I had envisioned exactly how I wanted the final product to look. I was going to create what would look like LED-lit flowers. The curved petals would provide an opportunity for the LED bulb’s light to disperse. Something else that was appealing about this idea was that no flower produced would look the same. The image on the right shows the very first “flower” created and connected to the LED bulb, battery, and switch. Although this initial prototype lit up beautifully, there were many construction issues. Once again, time played a major role in making this sort of create-it-yourself project unappealing.



With a vision of design in mind, it was time to refine the construction process. There were several goals for the final construction of the product. First, as this product would probably be produced in multiples, it was essential that the construction process not take extreme amounts of time. Next, skills such as soldering needed to be simplified or eliminated. Although this project introduced me to the practice of soldering and gave me some practice, it was quickly evident that the soldering process was tedious, time-consuming, and potentially dangerous. Finally, there needed to be a refinement of the reshaping process for the plastic bottles. Many of the

cut and shaped pieces, which were clear, were being burned, leaving brown spots on the plastic. Also, larger pieces took more time to melt and reshape.

One possible solution would eliminate the first two construction issues. Using small, prefabricated LED bulbs with built-in switches and batteries would save time and eliminate the process of constructing the connection to a battery and switch with soldering tools. After researching options online, easily accessible and inexpensive prefabricated LED alternatives were found and purchased. Although there were several options for the colors of the LED lights, I opted for a traditional white bulb as well as a continuously color-changing bulb. A total of twenty small LED lights were purchased. The photo below shows what these lights looked like as purchased.



To eliminate the third construction issue, smaller pieces of plastic were cut from the bottles and reshaped. Although this was still a lengthy process, there were not many preferable alternatives, and this method of construction encouraged uniqueness for each individual product.

After the primary construction issues were resolved it was back to the aesthetic design, which was very much already developed at this point. Once again, I set out to cut, reshape, and adhere “petals” to the LED light. Hot glue was used to quickly adhere the petals together and proved to be a great option as an adhesive, as it was clear and unnoticeable. Nonetheless, the first flower, a medium-sized one, took nearly two hours to construct. Before construction issues were resolved, a typical LED flower that was soldered to its battery and switch took about five to six

hours to complete. A smaller flower was later constructed in about an hour. The series of images below display some of the final LED flower products both lit and unlit.



Above are two examples of the final product. The flower on the left took about two hours to construct and the flower on the right took just about an hour.



The above images are of a flower that is turned off (left) and the same flower with its switch turned on (right).



Above is a smaller flower with its LED switch turned on.



The photo above zooms in to the details of a lit flower.



Above is a series of photos showing the continuous color-changing characteristic of the LED bulbs. The switch is turned on and the LED self-cycles through thousands of colors using only its three bulbs (red, green, and blue).

There are several concepts and goals that this project aimed to achieve. Many of these involved create-it-yourself construction processes, sustainable design practices, and exploration of newer LED technologies. However, within the design itself there were several smaller issues addressed and goals set to achieve.

One particular goal of this project was to create a cordless and portable light. Today, most lighting products on the market require a socket to be plugged into. My final product design utilized small batteries instead of cords. However, this particular type of battery, a CR2025, was intentionally used because it also comes in rechargeable forms. At a slightly higher cost, rechargeable batteries and a charger can be purchased so that these LED flower lights do not waste batteries over time.

Since the LED flowers lights are portable, options for arrangement and usage of these products are endless. At a small cost, a glass bowl and sand were put together with some of the flower lights to create what looked like a small flower arrangement. These lights could be arranged in pots and bowls or they could simply be placed on a table. They can be carried around in the evenings and act as a small nightlight. These LED flowers could act as tea lights used to decorate for weddings and other occasions. In fact, in doing this project an engaged friend sparked interest in having something similar to these products be created for her reception. The lights may not be flowers at all. Plastic pieces may be cut and shaped to create other forms. The endless opportunities for this project are a major result of their portable and rechargeable capabilities.

The unique interpretation of a product was a major goal for this project. Rather than label this project as a “lamp” or “nightlight,” the goal of this project was to leave the term for the product to be open-ended to the user. Each user may interpret this product in different ways, but

I will simply call it a “light.” I believe that all too many products in the marketplace today are labeled or advertised for specific uses or specific users. Product designers must begin to focus more heavily on the universality of a product’s design and its effect on users. When titles, descriptions, and characteristics of products are left open for interpretation, the amount of opportunity for creative usage by the user becomes endless. This project sought to achieve that level of creative opportunity and interpretation through the use of simplistic construction processes, LED technologies, and commonly recycled plastics.